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Analogies between Plants & Animals.

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An
Inaugural Dissertation
On the
Analogies between Plants and Animals,
Submitted to the examination
of the
Revd. Frederick Beasly -- Provost
the
Trustees and Medical faculty
of the
University of Pennsylvania,
for the degree of
Doctor of Medicine
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By John ——— of Kentucky

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A Sketch of Analogies between Plants and Animals.

"each moss
"Each Shell, each crawling insect, holds a rank"
"Important in the plan of Him who framed,"
"This Scale of Beings; holds a rank, which lost"
"Would break the chain, and leave a gap behind"
"Which Nature's Self would rue" —

When we contemplate Nature with the calm scrutiny of philosophy, we shall be struck with the order, harmony & symmetry, which pervade the Universe; from the bright spheres above, to the most minute vegetable production. In no instance do we observe order, harmony, and symmetry more remarkably shewn forth, than in the vast chain of beings, which connects all Nature — binds each individual to its neighbour, and governs and sustains the whole.
I shall not attempt to unfold the leaves, in the great volume of Nature, which contain so many of her secret works, concealed from the sight of Man.

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My object is, to point out some of the analogies subsisting between Plants and Animals, and indicate the gradation that exists, from the most complicated organic machine, to the most simple form of vegetable existence.

The immense domain of Nature has been divided into the Animal, vegetable, and Mineral or Fossil, Kingdoms.

Between the vegetable and mineral or Fossil Kingdoms, there is a clear line of demarcation, evident to the most cursory observation

But between the animal Kingdom and the vegetable republick the criterion of discrimination is obscured by the remoteness of the traits of distinction, and the approximation of their analogies

"We are so accustomed, says the poetic and philosophic Darwin, to consider life and initability to be associated with palpable warmth and visible motion, that we find a reluctancy in ourselves to ascribe them to the comparative cold and motionless fibres of plants"

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But to pursue the plan of [illegible] which was enforced by precept [illegible] so [illegible] in the works of the immortal Bacon, we should be led to believe, that "vegetables are but an inferior order of animals anterior to entering on the investigation of the subject, [illegible] to [illegible] a [illegible] objections to the characteristick distinctions, as are drawn by [illegible] or with some emphasis of argument, between animals and vegetables.

The ingenious Bichat, in his Physiological Researches, has said "animal life is the exclusive attribute of the animal kingdom. By animal life, this great man wished to designate that order of functions, which keeps a communication with external objects and establishes those numerous relations which the animal sustains with surrounding things.

But this universally admissible fact invalidates this trait of distinction, that the polypus, and animals of the Zoophyte tribe, enjoy "none of those prerogatives, which superior animals possess. Therefore we must desert this untenable attack.

Richerand continues, that a digestive tube, an internal surface for nourishment, marks a difference

We must examine this more minutely, and reason on the data afforded us by Nature with closer vigilance — prima facie, at first view, we would allow the justice of the distinction, and concede the point without deeper consideration.

Compendiously all animals, whose structure can be anatomized by the efforts and ingenuity of Man, receive their nutriment through the medium of an apparatus appropriated to the fulfilment of digestion and assimilation.

Reasoning synthetically, or a priori, we would say, that this attribute marked a visible difference; but should we analise the question more closely, we would acknowledge that an identity of digestive structure obtained in some plants, and a few animals do not enjoy this cavity.

Consider the myriads of animalcules that float with silent celerity in all fluids!

Spallanzani ascertained, that animalcula infusoria, after desiccation, were reducited into the white enjoyment of life, by the application of

distilled water; like hybernating animals roused by the genial influence of a vernal Sun.
Can we suppose, on rational grounds, that those almost inconceivably minute beings possess the cavity which this acute physiologist considers as constituting the essence of animality?
I think it extremely problematical.

But Richerand contends that we should reject the Zoophytes which form Sponge, from the exalted region of animal nature, because they is not hold out this beacon of distinction, which he desires to put upon Nature.

Men untrammeled by the shackles of Fallacy reject this species of retrocession, as obvious discordant to the laws of Nature, and unfavourable to the advancement of Science.

The Stomach of the polypus is but a cul de sac; an organ susceptible of a reciprocity of actions — which now performs the functions of a digestive apparatus, and now the purposes of cuticular action.
Insuch as the general system of this creature's System perform the office of digestion and assimilation: inversion does not impair the vital efforts of the animal, nor in the least diminish the excitability of its System.

*"Ludwig defines vegetables to be "natural bodies, always endowed with the same form, but deprived of the power of locomotion" "Every branch of this definition is, with equal propriety, applicable to precious stones, salts, and some 'animals.' Smellie p. 10

Their whole surface is a stomach: the surface of plants is analogous to this creature's cavity for imbibition.

"Quemadmodum terra arboribus, ita animalibus ventriculus"

This quotation clearly implies, that the roots of a plant fulfil the same purposes, of digestion and assimilation, that the chylopoetic viscera of an animal perform.

We therefore think this feature of distinction a mere ignis fatuus of an excursive imagination, a loose conjecture floating in the mind, not based upon observation.

Ludwig, and many others, have asserted, that the power of locomotion is peculiarly characteristic of animals.*

They were not aware of the fact, that many animals, as oysters, the Mollusca, or naked sea worms, Corallines or Corals, are as immutably fixed to their rocky habitation, as vegetables to the soil in which they vegetate.

Polypi, build up immense masses of coral rock, more durable than wrecks: it is conjectured that the Otaheite islands are the products of these minute and multitudinous animals.

Sensation has been laid down as the sine qua non of animal existence

"A plant, says Lingius, is a living but not a sentient body, which is fixed in a determinate place, and grows, increases in size and propagates its species"

Life, says the learned Smellie, without some degree of sensation, is an incomprehensible idea"

The inquisitive & sagacious Buffon remarks, "if sensation implied no more than motion consequent upon a stroke or impulse, the sensitive plant enjoys this faculty."

"But, if by sensation we mean the capacity of perceiving and comparing ideas, it is uncertain whether brute animals are endowed with this power."

Many insects pourtray a sensibility tantamount to the state of sensibility evinced by the fall insect, the polypus, and a numerous tribe of ephemera.

A brain, has been insisted on by some, as a decisive criterion of discrimination.

But the polypus & many other insects are deprived of that organ.

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Dr. Smith, the learned president of the Linnean Society in London, remarks, in his recent written work on Botany, "the most satisfactory remark I have for a long time met with on this subject is that of Mirbel, in his Traité d'Anatomie et de Physiologie Végétales. He observes Vol. 1. p. 19. "that plants alone have a power of giving nourishment, though not indeed exclusively, from inorganic matter, mere earths, salts or airs, substances containing incapable of serving as food for any animals, the latter seeking in what is or has been organized matter, either of a vegetable or animal nature. So that it should seem to be the office of vegetable life alone to transform dead matter into organized living bodies."

"This idea, observes the Dr., appears to me so just, that I have in vain sought for any exception to it."

After a perusal of this quotation most minds, should we turn to the pages of the acute Dr. G. Lordyce.

"I put gold fish, says the Dr., into distilled water, impregnated with air of the atmosphere,

in which they lived, grew, and threw out fecalent matter, for six months.
"Therefore it cannot be doubted that animals may live on pure air and pure water; and that their fluids or solids may be immeadiately produced from these sub stances." p. 80. work on Digestion
The existence of the anamalcula infusoria, moreover, contradicts this position

Without an effort at embellishment we conceive this trait of distinction dissipated. The keen and observant Fourcroy, by his experiments, has dispelled all mist, or "cloud dust", of controversy, from this part of the feild.

Dr. Smith has subjoined, that if any doubt lowers over the question, the simple experiment of burning will decide the point. But it has been observed, that vegetable productions, such as the gluten of wheat, Coutchouc, and the juice of the papaw tree, give out in burning nearly the same peculiar odour which is afforded by animal matter. note to Smith's Dissy p. 24

The celebrated definition of the great and immortal Linnaeus has been reverberated, like the echo of St. Peters cathedral, until it has sunk into a faint murmur.

The imposing consequence of a name has been exemplified in every era, and in every department of life.

Such has been "the magic of a name", as Bacon expresses himself, that error has defied reason, truth, and the rhapsodies of sophistry, for the dictates of philosophy.

Even the sage Aristotle, seated on not less than a papal throne, fulminated his literary bulls over all the vassals of philosophic credulity, and for the period of two thousand years, says Dr. Reid, he governed the opinions of the most enlightened part of the species.

The history of our own profession teems with facts of similar import.

The absurd doctrines of preternatural tension and tenacity of the blood, of concoction of the humours, of putrefaction of the fluids, and many other silly notions, were, like the responses of Delphi, received as sacred oracles from the pens of Hippocrates, Galen,

Holman, Sydenham, Boerhaave, & several other luminaries of our Science.

In practical points ~~the~~ the like fatality has obtained

We therefore cannot be surprised, when we learn, that the following definition of Linnaeus has been handed down, like a precious family relic, with soft touch and rapturous praise, to the present enlightened period of time.

"This magazine of knowledge remarks, in his Fundamenta botanica," lapides crescunt, vegetabilia crescunt, et vivunt, animalia crescunt, vivunt, et sentiunt."

We cannot readily frame to our minds the idea of growth without nutrition and expansion by the intervention of assimilating organs. Stones increase in magnitude by the simple accretion of new matter, but this is not growth: growth implies expansion by the powers of assimilation.

"Vegetables grow and live" - but here is a postulatum. Linnaeus takes it for granted that vegetables live in strict harmony with the exact laws of [illegible].

"Animals grow, live, and feel".
Smellie justly remarks, that growth, life, and mere sensation, convey the most ignoble notions of animated beings. p. 11
"These are only the profane properties of animals."

This refutation includes none of the more exalted attributes of animals; none of their instincts; none of those features of character which strongly mark a difference between animals; and the assemblage of a number of which, shews forth man's superiority, over all created beings.

We must therefore coincide with the eloquent Buffon in considering that neither progressive motion, sensation, nor mode of nourishment, points a distinction between animals and vegetables.

Other more feeble barriers of distinction have been erected by the efforts of speculative ingenuity; but the breath of opposition has dispersed them, "like the baseless fabric of a vision, and left not a rack behind"

I now proceed to point out some of the more prominent analogies, and intimate the more clearly marked features of agreement, between animals and vegetables.

Commencing with the reproduction of the species in each, and following the boundary line of resemblance to their "ultimum moriens" of existence.

As preparatory to the fulfilment of the functions of impregnation, an aptitude must exist in the organs appropriated to the discharge of this act.

This aptitude the higher animals conspicuously evince — union of the sexes being the result of a voluntary power.

This "passion of love" is transcendental instinct in animals: it is as truly so in plants.

The venereal excitement is not under the dominion of reason in animals, of inferior type to man.

The disposition to venery is evolved at certain seasons of the year, varied according to the constitutional "a. animis" and temperature of climate.

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In like manner, vegetables evince this tendency at a certain epoch of their duration.

The Abbe Spallanzani has observed, in his great work, which has shed a refulgence on physiology, that the doctrines of the ovaists, and of the vermicelists, and that founded on the two liquors, have been transferred, with necessary modifications, to plants.

The doctrines of Palingenesis, and Epigenesis are the "leading heads, or general divisions" of the numerous theories of impregnation. The first of these doctrines supposes the preexistence of germs.

By some of the advocates for this doctrine, it was maintained that all the same species ab initio were neatly incased, one within another, so that, according to this notion, our first parent must have contained the countless millions that have propagated our globe.

Darwin, whose poetry often "out-herded" his philosophy, sings with more melody than truth;

"Grain within grain successive harvests dwell,
And boundless forests slumber in a shell".

* Blumenbach p. 333.

† Blumenbach p. 335

"Some imagined the germs to be the spermatic animalcules of the male, others imagined them to exist in the ovaries of the mother.* But though this hypothesis entirely fails in affording us an explanation, at all satisfactory, of this mysterious operation of the animal and vegetable economy

Let us notice the doctrine of Epigenesis it supposes, "not an evolution of fictitious germs by conception, but a true and gradual formation of a new conception from the hitherto formless genital matter."†

"Animals and plants are capable, by the same organick power, of forming, separately and in succession, their kind." This Plastick Power, Blumenbach denominates, Nisus Formativus.

"The particular manner in which the grand object of impregnation is accomplished, is yet, to us, a "hidden light."

"This Sacrum Sacrorum of Nature has not been explored.

Many have, in the dreams of fancy, thought they had entered the "inner temple," when really they were exterior to the "outer temple," pealing anthems to hypothesis.

But endeavoring at concealment, I think, that the doctrine of Spontaneity quadrates with the facts offered us by the vegetable creation.

We cannot admit, that a liquor, in form of a powder, called pollen, shed from the excited anther in the stigma, with any product of the pistil, produces the seed.

Neither is it possible, for the liquor of the pollen, to be conveyed to the pericarp, or seed vessel, by a duct, and thus by direct contact, and immediate agency, stimulate into life the seed.

Spallanzani and Bonnet in vain searched, with sight ennobled by philosophy, for this tube.

Mr Adanson has laid it down as a certain truth, that the smallest imaginable particle of pollen, falling upon the stigma

will produce impregnation.
Spallanzani found that a diluted solution of the semen of the male frog, applied in the smallest quantity to the ova, as they issued from the female, was sufficient in fecundation.

We might apply imagination & fortunes to bend the rigidity of the theory, in the first application of the semen, but we could not explain all the phenomena attending vegetable impregnation.

Different parts of the vegetable economy sympathize in action, and sympathize in feeling.

For example, when we cut the minutest portion of the leaf of the mimosa, the whole plant trembles, and falls into a state of collapse.

We think that impregnation is accomplished by the influence of action, communicated by means of sympathy, from the stigma along the pistil to the pericarp.

* Rees Cyclopædia, Art. Generation.

Errata. Here I must deprecate the severity of just criticism for the omission of several words, that have been "stamp'd in the mint" of American genius.
I can only plead the authority of men, if not of classical, yet of distinguished [illegible]

The usual division of animals into oviparous and viviparous, though comprehensive, is not perfect.

Some animals are neither oviparous nor viviparous, but truly gemmiparous, generating by shoots.

The armed polypus, the hydra of Linnaeus, the sea anemone (actinia) generate like plants, by sending out shoots.

The hermaphrodite and monoicous plants closely resemble the acephalous mollusca, in the accomplishment of the generative process.*

"Many striking analogies, says Smellie, subsist between the eggs of animals and the seeds of plants."

The fœtus in utero, in the early months of pregnancy, has been analogized to the seed in the earth.

After the ovum is deposited in the uterus, the fœtus and lobules of the chorion drink in nutrition from the secreted fluid afforded by the internal membrane of the uterus.

† Smellie.

"The placenta, formed of those vessels, resembles in its functions the cotyledons of a seed after its emergence from under the surface of the earth.
"The seed as the egg is covered with a shell or crustaceous membrane."
"Another membrane invests the fungy lobes of the seed. Each lobe, like the yolk of the egg, is involved in a separate membrane."
"Eggs and seeds are [illegible] simultaneously formed on the same plan and destined by nature to fulfil the same general intention."†

Richerand observes, "the existence of the fœtus in utero is solely vegetative." Dr. Osborn, p. 36, denies the fœtus the enjoyment of sensation.

Perhaps, his objections to the fœtus possessing this faculty, are as valid as the objections raised to vegetable sensation.

Hybrid productions result from vegetable union, between different varieties and species, as between animals

* Unlike

Lamesson found that, "the pistil of the nicotiana rustica, which has egg shaped leaves and yellowish corals, with the pollen of the nicotiana paniculata, with round leaves and greenish petals, produced a hybrid plant resembling both species in every part." p. 38.

A vegetable fetus has been discovered in plants

"In the end of Autumn, if the coats of any bulbous root are dissected the entire plant in miniature will appear in the centre of the root"*

M. Mariotte and many other writers, have seen in the bulb of the tulip, not only leaves, but even flowers and the stamina

"Every animal and vegetable is destined, by the laws that regulate the harmonic actions of their system, to work out their existence in a limited space of duration. Some plants spring up, exhale their lives in the passing hour, and are seen no more.

Many microscopic animals expire a few hours after their existence.
Certain plants spring up and unfold themselves in the vernal season.
Many insects evolve their existence in this season.
They terminate their vital course and others come on the stage.
We see infinite wisdom displayed in ordaining that a diversity should exist in the organic creation.
Were all plants to shoot forwards at once to the melody of vernal nature, they would inevitably choke each other.
If the immense profusion of creatures that are successively introduced on the arena of life, were to burst forwards at once, the besom of destruction would sweep them off in one general wrap.

Having touched upon the general analogies existing between Plants and animals, in the structure and economy of the organs appropriated to generation, we will remark a few lines of resemblance subsisting between

their organization and functions.
The vascular system is the leading upon which the fabrick of the more perfect animals is built.

In all animals, we observe some structure calculated to answer the purposes of bones.

In plants the ligneous portion fulfils the offices of bones.

Both animals and plants possess a parenchymatous portion

The ligneous and parenchymatous portions are regularly disposed, in such a manner, as to allow the intervening expansion of vessels; which vessels are destined to perform the different functions necessary to the nourishment, growth, and maturity of the plants.
Between the organization of minerals, (which are gifted with many organs, destined to exercise high powers of action, and fill a large range in the field of exertion,) and insects. we remark a wide chasm, far as between the Moles dim curtain and the Lion's mane.

But numerous insects are entirely destitute of particular organs.
Many have no heart, nor veins, nor seperate pulmonary organs.
In those semi-animated beings, which are the connecting link in the great chain of nature, we observe an organization extremely simple, and reduced to the exercise of a few functions.
Like vegetables, they are stationary; have vessels; and fluids circulating in those vessels; absorbents to take up a nutrient fluid; powers of reproduction, and are limited to exist on the bounty of nature an allotted period of time.
The lymphatics, in the roots of plants, performing the office of lacteals:
They digest and assimilate the fluids presented.

It is well known, to every person conversant with vegetable physiology that, the vis insita of the vessels draws fluids through them.
It is not mere capillary attraction but a living process, instituted by a living body.

* By this expression I mean, that the substances secreted do not reside, in proper nature, in the blood.
The materials may exist, but the plan is the architect or manufacturer.

The vegetable secretion is accomplished in a manner analogous to animal secretion.

The substances secreted were not in the circulating mass,* anterior to the action of the secretory vessels: the incomprehensible operation of the vessels created the substances secreted, to their respective glands.

Vegetables have irritability, sensibility, and Dr Darwin thinks, voluntary motion. The vessels, in the conclusion of their respective fluids, in the absorption of nutriment, & in the secretion of peculiar fluids, as resinous substances, honey, and balsamic articles, bountiful unfeigable proofs of irritability.

Van Uslar found, that electric impulses destroyed the irritable action of the vessel: after a smart shock the vessels would not bleed, or discharge their fluids, after being cut.

The Dionæa Muscipula, venus' fly-trap, presents us with a strong example of vegetable irritability.

The leaves of this plant are armed with spines on their upper edge, and are spread on the ground around the stem.
"When an insect creeps on any of them in its passage to the flower or seed, the leaf shuts up like a steel rat-trap, and destroys its enemy". Loonomia p. 131.
Dr. W. P. C. Barton to whom I owe many of my ideas on this topick, observes "one more plant I will instance as an evidence of the spontaneous motion, or irritable action, of vegetables.
"It is the well known Berberis vulgaris or Barberry: a shrub remarkable for irritable property of its stamens, when touching grain in its vicinity.
"The irritability of the stamens of the Barberry is well ascertained, and it is one of the best examples, which can be given of this property.

The question of the sensibility of plants has been agitated with vital interest of genius and ingenuity, as a question, that the heart could dictate, or the soul revise.

*"It is a plant of [illegible] class diœcia, order decandria of the Linnean arrangement, or as Darwin says, of the class of "two brotherhoods, ten males".

[illegible] Robertson.

The Mimosa Sensitiva, or Sensitive plant, is as "trembling alive all over", as the most delicate lady who is lulled on the couch of luxury.

"Weak with nice sense the chaste Mimosa stands,
From each rude touch it withdraws its trembling hands."

The sensibility of plants is evinced by the approach of the anthers, in some flowers, to the stigmas.

The sleep of Plants is a strong corroborating circumstance in favour of the opinion of their enjoying sensibility and irritability. Although this idea may appear "teeming with hyperbole", but it is perfectly philosophical. A repose is as necessary, for the replenishment of the vital principle in Plants, as in animals.

A beautiful illustration of vegetable spontaneous Motion is given us by the Hedysarum gyrans.

This plant has been called also "Dionea gigantea, by botanists."*

"Its leaves are continually in spontaneous and quick motion, some rising a little

The spontaneous movements, or what Dr. Darwin terminates, the voluntary action, of plants, lines since: a cucumber vine, (Cucumis Sativus) by a species of instinct directs its branches to a support, as bent: the hop vine, (Humulus lupulus) by intuitive action leaves its stalk, caught up a rail.

rolling: others winding circularly, by twisting their Stems."
"This takes place when there is no air, and seems to be as necessary to the plant as herbivorous respiration to animal life".

"The leaves, says Smellie p. 14, of the Tamarind tree (Tamarindus indica) contract round the tender fruit, and protect it from nocturnal cold.
"The Cassia or Senna, the Glycine, and many of the papilionaceous plants, contract their leaves in a similar manner." †

The leaves of plants perform the same functions in the vegetable, that the lungs do in the Animal economy.
By varnishing a leaf you injure the health of the plant.
In a qualified sense, "Oxygen gas, the pure lungs of all that breathe or live", neither animals nor vegetables could exist without the influence of Oxygen.

[illegible] (p. 206. Ex. [illegible]) [illegible] after noticing the salutary operation of carbonic acid gas, applied to the root, [illegible] in pushing forward growth, says: "on the contrary, carbonic acid gas, [illegible] atmosphere, by confining a little [illegible] in the undiluted gas over [illegible], is injurious to the health of the plant, especially in the shade".

Deprive a plant of its foliage [illegible] "It is labouring under an asphyxia or lying of a suffocation".

"Some plants, as well as animals, are amphibious, as the Rush (Juncus) and the frog: others are parasites.

The Mistletoe (Viscum) feeds on the bark and every animal is fed upon by some other kinds.

Some parts of our system partake in vegetation; as the hair and nails.

A relationship exists between the [illegible] of certain plants and animals.

Mr. Ricere has descanted with dignity and expansiveness, on the harmonies of Plants and Animals.

Nature, a mother kind alike to all;
acts the part of a benevolent caterer.
No insect, however mean in the eye of vain man, is unprovided for; or introduced on the Stage of existence to be poisoned by the cup of hunger.

The vegetable, as the animal constitution, is receptive of an hereditary impress.
We learn from the best of natural vegetable, with struggle to maintain the vants of its infant.
Such plants put forth their leaves and blossoms a fortnight earlier, than indigenous ones.
Vegetables evolve heat. This is proved by their keeping up an equanimity of temperature, but in a much less degree than animals, in different degrees of atmospheric temperature.
Dr. Smith remarks, "heat can scarcely be denominated a secretion, and yet is undoub

* Smith's Botany. p. 23.

"Fruits and leaves, situated in the Sun, preserve themselves cool, while surrounding objects are heated.
"Sonnerat discovered in the island of Luzon a rivulet, the water of which was so hot, that a thermometer immersed in it rose to 75° Fahr." Plants grow with bare legs.
In the high latitudes plants grow.
"Thirty species of plants grow in the island of Fitzherjem. note to Smith's Botany. 23-4

tedly a production, of the vegetable as well as the animal body, though in a much lower degree in the former than the latter."

"Mr Hunter appears to have detected this heat by a thermometer applied in frosty weather to the internal parts of vegetables newly opened."*

Thus have I endeavoured to point out some of the more overt analogies between Plants & Animals.

The Nature of our Dissertations, will not allow the prolongation of enquiry, or the expansion of our "little fold" to a wider Surface.

Nature, has fixed a graduated Scale on organic creation, from the humble Moss we trample under foot, to Man "great Lord of all".

Let us, with humble reverence suppose that vegetables participate in some low degree of the common allotment of vitality; and that one great Creator

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hath appointed food to all living things,
"in number, weight, and measure".
Therefore, let us acquiesce with Pope
in saying:
"Far as Creations ample range extends,"
"The Scale of Mental, Sensual powers ascends:"
"Mark how it mounts to Mans imperial race,"
"From the green Myriads in the peopled grass:"

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"Vast chain! which from God began;"
"Natures ethereal, human, angel, Man;"
"Beast, bird, fish, insect, what no eye can see,"
"No glass can reach; from infinite to thee"
"From thee to Nothing."— —

— —

And conclude by saying, with placid
emotions of pious rapture;
"All are but parts of one stupendous whole"
"whose body Nature is, and God the Soul."

Finis.